Space Weather Technical Forecast

Issued on Monday, 01 July 2024 at 13:23 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of M-class flares throughout. Chance of G1/G2 Minor/Moderate storm intervals days 2-3 (02-03 Jul).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity has been Moderate, with an impulsive low-level M2.1 flare observed from AR3730 in the southwest at 01/1102 UTC. There are currently thirteen regions on the disc, most of which are small and simple. AR3729 in the southeast quadrant is a moderately long spot, exhibiting gamma magnetic complexity, with recent slight development of intermediate spots. AR3734 in the northeast quadrant is also a moderately long spot but smaller in areal extent, showing limited magnetic complexity and minor changes to intermediate spots. There has been some continued slight growth in AR3730 in the southwest, which exhibits a north-south aligned magnetic orientation. AR2719 rotated around the southwest limb and AR3720 faded to plage.

A large filament in the southwest was observed lifting off from the Sun's surface around 29/1530 UTC, with a subsequent CME observed in coronagraph imagery. Analysis suggests this could give a glancing blow at Earth on days 2 or 3 (02-03 Jul).

Solar Wind / Geomagnetic Activity: Solar winds observed by ACE and DSCOVR at L1 are still showing weak CME effects after the arrival on 28 Jun. Wind speeds have been slightly elevated, ranging between 460-500 km/s. Density was around average or below. The Interplanetary Magnetic Field, Bt, was weak and on a declining trend, falling from 7nT to around 3nT. The north-south component, Bz, varied weakly between +4/-7nT. Phi angle has been predominantly positive (away from the Sun). Geomagnetic activity was Unsettled to Active initially (Kp 3-4) before becoming Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux observed by GOES18 remained at background levels. High energy electron flux (greater than 2MeV) observed by GOES16 was at background levels. The 24-hour fluence remained below Active, with 1.24e6 integrated pfu observed at 01/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Moderate activity is likely to continue, with a chance of isolated M-flares.

Solar Wind / Geomagnetic Activity: Effects from the CME that arrived at Earth on 28 Jun continue to wane. A CME from a large filament lift-off on 29 Jun may give a glancing blow either on day 2 or day 3 (02-03 Jul). Otherwise, there are no significant coronal holes on the disc to give any fast wind influence.

Geomagnetic activity is expected to be generally Quiet to Unsettled (Kp 1-3), with Active (Kp 4) intervals and a chance of G1/Minor to G2/Moderate storms (Kp 5-6) on days 2-3 under CME influence, however confidence is fairly low. Returning to mostly Quiet to Unsettled conditions on day 4 (04 Jul).

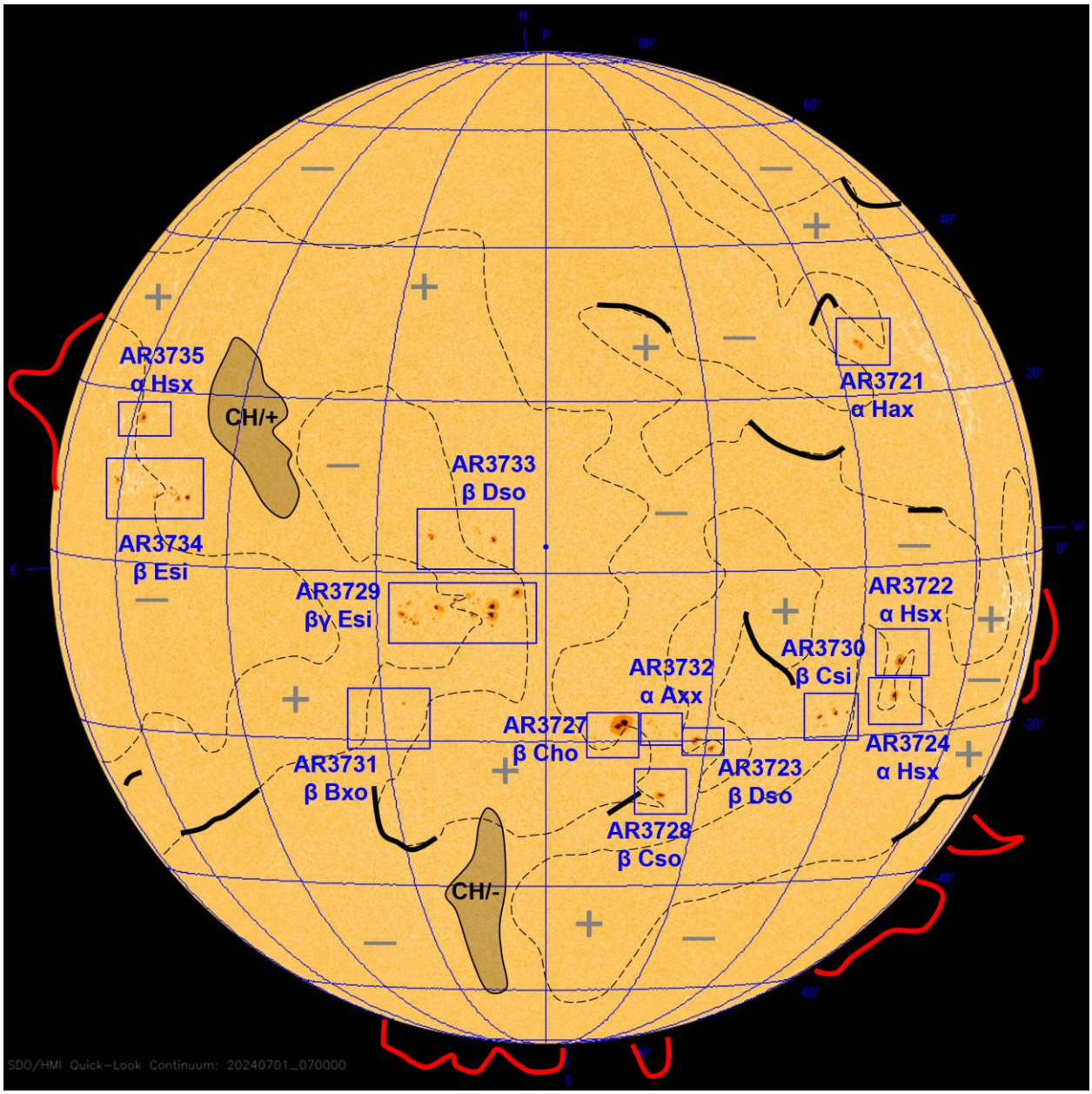
Energetic Particles / Solar Radiation: High energy proton flux is expected to remain at background levels. However, there is a very slight chance of exceeding the S1/Minor Storm

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

threshold should any notable flares occur. High energy electron flux might show an increasing trend after the recent CME influence, though further suppressions are possible with future CME arrivals. The associated 24-hour fluence is likely to remain below the Active threshold however, with a slight chance of exceeding later in the period.

Figure 1. Solar Analysis Valid 01/0700 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Geomagnetic Storms:

Effects from the CME that arrived at Earth on 28/0910 UTC continue to wane. A large filament lift-off was observed around 29/1530 UTC in the southwest, with a resulting large CME observed leaving the Sun in coronagraph imagery. Analysis suggests a glancing blow either on day 2 or day 3 (02-03 Jul) with the bulk of the ejecta passing below Earths orbit. There is significant uncertainty in the timing of this feature, however.

There are no significant coronal holes on the disc to give any fast wind influence.

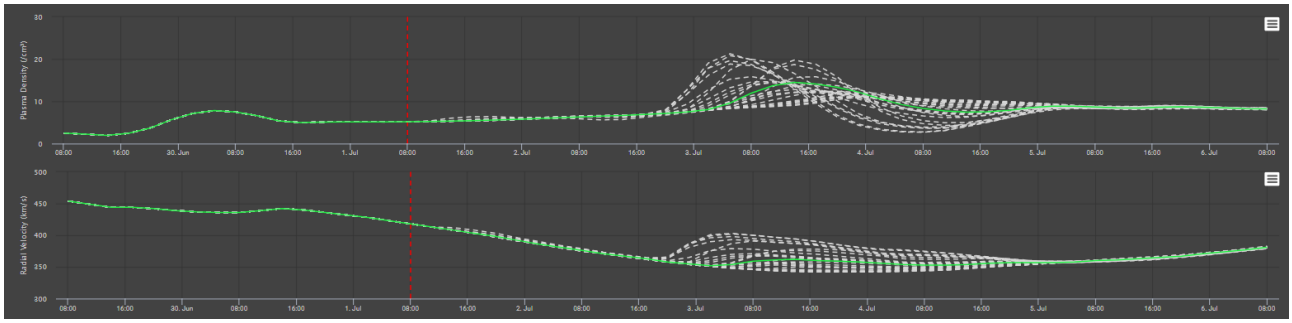
Geomagnetic activity is expected to be generally Quiet to Unsettled (Kp 1-3), with Active (Kp 4) intervals and a chance of G1/Minor to G2/Moderate storms (Kp 5-6) on days 2-3 under CME influence, however confidence is fairly low. Returning to mostly Quiet to Unsettled conditions on day 4 (04 Jul).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	40	30	5
Strong	G3	No	1	10	5	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
29/2010	Partial	Filament	SW	780 km/s	03/0000 UTC +/- 12 hrs	Glancing blow likely. Timing Uncertain.

Figure 2: MOSWOC ENLIL ENSEMBLE



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

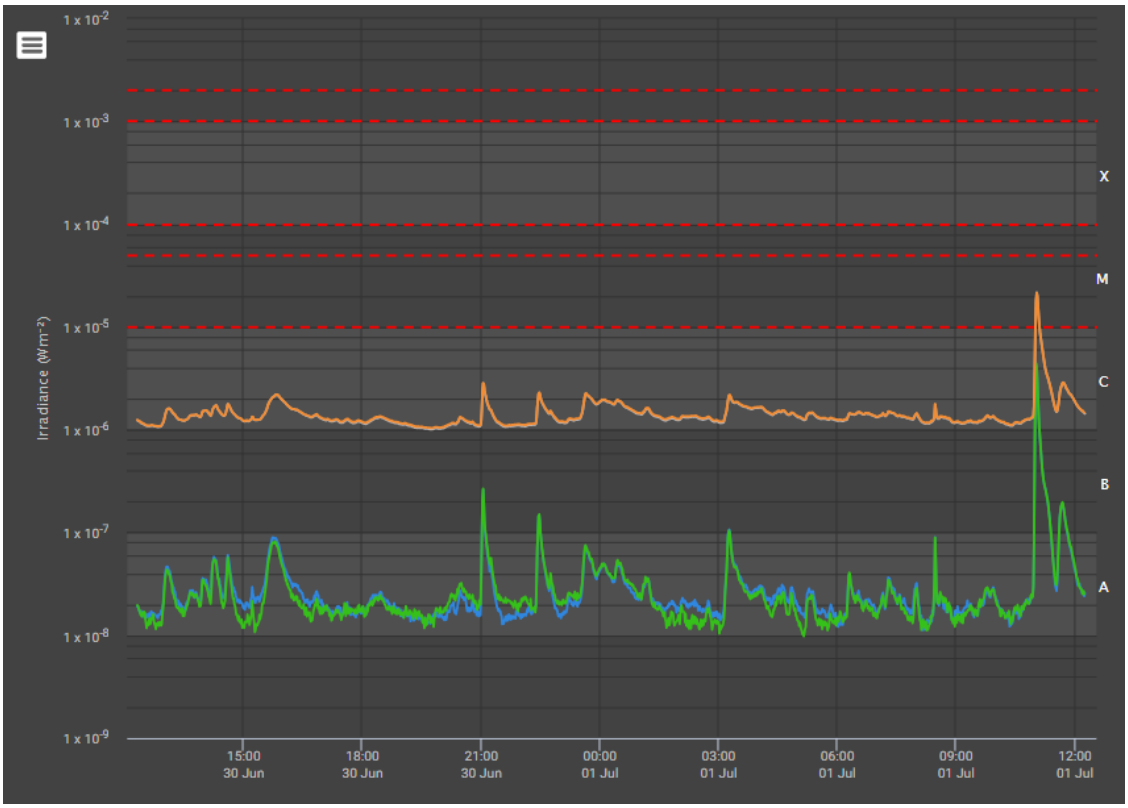
Radio Blackouts - X-Ray Flares:

There are currently thirteen regions on the disc, most of which are small and simple. AR3729 in the southeast quadrant is a moderately long spot, exhibiting gamma magnetic complexity, with recent slight development of intermediate spots. AR3734 in the northeast quadrant is also a moderately long spot but smaller in areal extent, showing limited magnetic complexity and minor changes to intermediate spots. There has been some continued slight growth in AR3730 in the southwest, which exhibits a north-south aligned magnetic orientation. AR2719 rotated around the southwest limb and AR3720 faded to plage.

Each individual region only contributes a small amount to the overall flare risk. Overall, the flare risk has been kept flat throughout with a chance of isolated M-class flares, and a very slight chance of X-class flares.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	40	40	40	40
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 3: 24 hour X-ray trace.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Solar Radiation Storms - (High Energy Protons):

High energy proton flux, as measured by GOES-18, is most likely to remain at background levels. Despite a large amount of sunspots on the Earth-facing disc, they are relatively small and magnetically simple, making proton enhancements unlikely.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

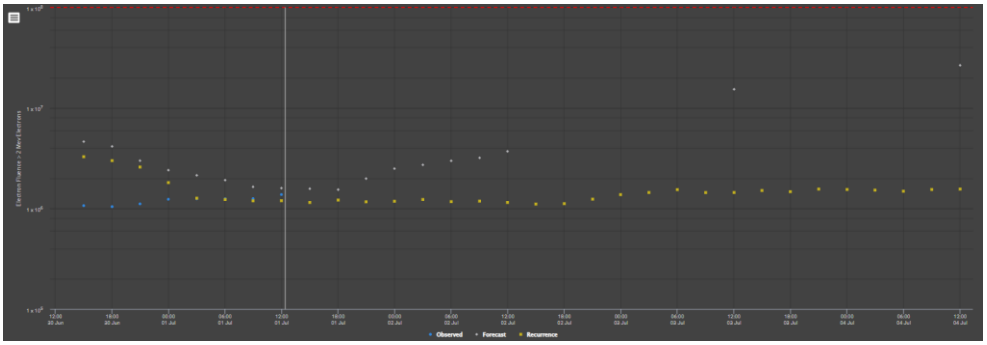
High Energy Electrons Event (≥ 2MeV):

High energy electron flux, as observed by GOES-16, is expected to continue at background levels for the start of the period. The recent CME enhancement may have caused an increase in electron flux below GEO, but the potential for further CME arrivals could suppress this once again. Overall, electron flux is most likely to stay at background levels, but as the solar wind speeds decline there is the possibility of an increase to peak at moderate or perhaps high levels later in the period.

Associated electron fluence is most likely to persist below the Active threshold (1e8 integrated pfu), but with a slight chance of an increase above Active later in the period. MOSWOC REFM is forecasting a below Active trend through the next three days, which reflects the most probable outcome.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	5	10	5	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: MOSWOC REFM fluence observed/forecast/recurrence



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.